

REMARKS

Reconsideration of the above-identified patent application in view of the amendments above and the remarks following is respectfully requested.

The claims before the Examiner are directed toward a method for controlling access to a communication network by processes running on a host device, and to a channel adapter that implements the method. To enable the processes to access pairs of work queues that couple the host device to the network, each process is assigned a single respective doorbell address in an address range, in an address space of the host device, that is occupied by the channel adapter.

§ 102(b) Rejections – Parthasarathy et al. ‘392

In the Office Action mailed January 25, 2006, the Examiner rejected claims 10-15 and 25-30 under § 102(b) as being anticipated by Parthasarathy et al., US Patent Application Publication No. 2002/0184392 (henceforth, “Parthasarathy et al. ‘392”). The Examiner’s rejection is respectfully traversed.

Parthasarathy et al. ‘392 deal with a methodology and mechanism for remote key validation for NGIO/InfiniBand™ applications. Their methodology and mechanism have nothing to do with “doorbells” as defined and used in the present invention. The use of the term “doorbell” in their specification is always given in the context of a “doorbell manager” element or function, and reflects a totally common meaning and use, as described for example in the InfiniBand™ standard. The first mention of a “doorbell manager” (not even shown) in paragraph 0077 makes it absolutely clear that its function is a standard one of keeping track of the number of outstanding work requests.

Paragraph 0074 in Parthasarathy et al. '392 describes a Translation and Protection Table (TPT) and its function. A TPT (defined in the InfiniBand™ standard) is part of the mechanism used to validate access to memory, done by a device on behalf of a process while executing a work queue element (WQE). In other words, this is part of an execution process, not part of a submission of WQEs to the device process, which is the part covered by the claims of the present invention.

In the method for controlling access by a process on a host device to a communication network of the present invention, each process has a single doorbell address through which it can access a plurality of instances (*i.e.* queue pairs or QPs, also referred to as "work QPs" or WQPs, see specification p. 4), while still maintaining protection between processes. Per claim 10, the inventive steps include allocating to a process a plurality of instances (WQPs) on a channel adapter and assigning to the process a single doorbell address on the adapter for use in accessing any pair of the plurality of instances (WQPs). In other words, claim 10 refers to allowing the process to control a plurality of QPs through a single doorbell address. Parthasarathy et al. '392 do not do anything of the sort. Their method uses the standard control by a process of a single instance (WQP) through a respective doorbell address. The cited paragraphs 0074 and 0088 do not, in any way, recite "assigning to the process a single doorbell address on the adapter for use in accessing any of the plurality of the pairs of work queues".

Because Parthasarathy et al. '392 do not disclose the assigning step of the present invention, they do not anticipate claim 10. Moreover, they do not even render claim 10 obvious. Applicant respectfully submits that claim 10 is therefore patentable. Claims 11-15 depend on claim 10 and include all its limitations, and are therefore also patentable.

The rejection of claims 25-30 is for the same reasons as for claims 10-15. Applicant respectfully submits that Parthasarathy et al. '392 do not disclose a channel adapter comprising a plurality of pairs of work queues (WQPs) for allocation to a process on the host device and a single doorbell address in an address space of the host device for assignment to the process for use in addressing any of the plurality of pairs of WQs. Parthasarathy et al. '392 disclose a channel adapter in which each doorbell address is used for assignment of a single WQP, as common practice. Therefore, Parthasarathy et al. '392 neither anticipate nor even render obvious claim 25 and its dependent claims 26-30. Applicant respectfully submits that claims 25-30 are therefore patentable.

The above arguments were submitted in response to the Office Action mailed on July 5, 2005. In response, the Examiner wrote, in the Office Action mailed January 25, 2006, regarding whether Parthasarathy et al. '392 teach allowing a process to control a plurality of queue pairs through a single doorbell address:

Parthasarathy teaches controlling a plurality of queue pairs (two work queue pairs, VI, QP, WQP) through a single address ([0032], [0063], *etc.*).

Applicant respectfully disagrees. Paragraphs 0032 and 0063 have nothing to do with doorbell addresses. Paragraph 0032 discusses the relationship between queue pairs and channels. For example, paragraph 0032 states, in part,

A channel connection is simply an abstraction that is established over a switched fabric **100** to allow two work queue pairs (WQPs) at source and destination endpoints...to communicate to each other.

Paragraph 0063 discusses the relationship between a VI consumer, that "may be an application program" (*i.e.* a process), and virtual interfaces (*i.e.*, queue pairs) as follows:

VI architecture comprises four basic components; Virtual Interface (VI) in which work requests are posted to describe data movement

operation and location of data to be moved for processing and/or transportation via a switched fabric **100'**, VI consumer which may be an application program, VI provider which may be hardware and software components responsible for instantiating VI, and completion queue (CQ). VI is the mechanism that allows VI consumer to directly access VI provider. Each VI represents a communication endpoint, and endpoint pairs may be logically connected to support bi-directional, point-to-point data transfers over one or more designated channels of a data network.

In other words, paragraph 0063 discusses the relationship of processes with the channels of paragraph 0032 via the queue pairs, with no mention of how many doorbell addresses a process uses to access the queue pairs. As best understood, the process uses the prior art method of one doorbell per queue pair, as described in the specification on page 2 lines 23-26:

Each QP is associated with a different doorbell, which is mapped into a separate page...of the memory space.

Indeed, the only mention of doorbells in Parthasarathy et al. '392 is in paragraphs 0071, 0077, 0080, 0083 and 0087 that discuss completion queue/doorbell manager interface **720** that is (paragraph 0071)

...controlled by the Micro-engine (ME) 710 to perform many ME functions needed to implement the NGIO/InfiniBand™ and VI specifications...

so that, as best understood, Parthasarathy et al. '392 handle doorbells as in the prior art, one doorbell per queue pair. There is neither a hint nor a suggestion anywhere in Parthasarathy et al. '392 of any other way to handle doorbells.

To make it absolutely clear that the doorbell address recited in independent claims 10 and 25 is not an address of a communication channel, these claims have been amended to state that the doorbell address is in an address range occupied by the channel adapter in an address space of the host device. Support for these amendments is found in the specification on page 11 lines 11-13:

...wherein the HCA and memory occupy certain ranges of physical addresses in a defined address space of host 22.

and on page 12 lines 7-11:

To place work items (WQEs) on their allocated queues, processes 30 ring respective doorbells 36 on HCA 26, by writing to the appropriate doorbell addresses that are assigned within the address range occupied by the HCA.

Correspondingly, dependent claims 13 and 28 have been amended to recite “the address space of the host device” instead of “an address space of the host device”.

Amended independent claims 10 and 25 now feature language which makes it absolutely clear that the doorbell addresses of the present invention are addresses in an address range occupied by the channel adapter in an address space of the host device. Applicant believes that the amendment of the claims completely overcomes the Examiner's rejections on § 102(b) grounds.

With independent claims 10 and 25 allowable in their present form it follows that claims 11-15 and 26-30 that depend therefrom also are allowable.

§ 103(a) Rejections – Parthasarathy et al. ‘392 in view of White ‘425

In the Office Action mailed January 25, 2006, the Examiner rejected claims 1-9 and 16-24 under § 103(a) as being unpatentable over Parthasarathy et al. ‘392 in view of White, US Patent No. 6,058,425 (henceforth, “White ‘425”). The Examiner’s rejection is respectfully traversed.

As discussed above, the point of innovation of the present invention is the accessing of queue pairs, by a process running on the host device, via a single doorbell address. Because White ‘425 is cited only with respect to the presence in the prior art of an aspect of the present invention other than this point of innovation, amending independent claims 1 and 16 to recite this point of innovation suffices to

render independent claims 1 and 16 allowable over the prior art cited by the Examiner.

Independent claims 1 and 16 now have been so amended. Specifically, claims 1 and 16 have been amended in the manner of claims 10 and 25 to state that the doorbell address is in an address range occupied by the adapter in an address space of the host device. Claims 1 and 16 also have been amended to recite assigning a single respective doorbell address to each process. Support for the latter amendment is found in claims 10 and 25 as filed, and also in the specification on page 12 lines 11-15:

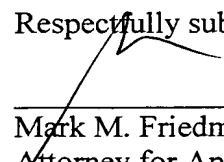
As shown in Fig. 1, each process 30 has a single doorbell page...even though in the case of PROCESS 1, this doorbell page can be used to access multiple QPs 34. (emphasis added)

Correspondingly, dependent claim 2 has been amended to recite “the address space of the host device” instead of “an address space of the host device”. Dependent claim 17 has been amended in the same way, although in the case of dependent claim 17 this amendment corrects an inadvertent typographical error, because claim 16 as filed recites “an address space of the host device”.

With independent claims 1 and 16 allowable in their present form it follows that claims 2-9 and 17-24 that depend therefrom also are allowable.

In view of the above amendments and remarks it is respectfully submitted that independent claims 1, 10, 16 and 25, and hence dependent claims 2-9, 11-15, 17-24 and 26-30 are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



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